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Research Article

ANTIOXIDANT LEVELS IN INDIAN ROSE, HIBISCUS, CHRYSANTHEMUM AND MARIGOLD TEA AND THEIR COMPARISON WITH BLACK AND GREEN TEA

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ABSTRACT

The traditional black and green teas are now being replaced by the herbal flower teas which have anti-cancer, anti-diabetic and anti-mutagenic properties. Herbal flower tea contains various phytochemicals such as catechins, flavonol glycosides, flavone glycosides and caffeine and pro anthocyanins. The present study was conducted with an aim to estimate the levels of phenolics, flavonoids content and antioxidant levels in Indian rose, marigold, chrysanthemum and marigold flowers for their use as herbal flower tea. The aqueous extracts of dried rose, marigold, chrysanthemum, hibiscus, green tea and black tea were analysed for total phenolics content, total flavonoid content and antioxidant power by using modified ferric ion reducing antioxidant power assay (FRAP). In the present study, the highest phenolic levels were found in rose tea (760.66 ± 5.03 mg TAE/gm) followed by marigold (594 ± 4.16 mg TAE/gm), chrysanthemum (432.66 ± 5.03 mg TAE/gm), Hibiscus (406 ± 7.21 mg TAE/gm), green tea (45.78 ± 5.8 mg TAE/gm) and black tea (42.45 ± 5.2 mg TAE/gm). Among flower tea, rose had highest antioxidant levels (39.03 ± 0.50 mg AAE/gm) and least in hibiscus (9.25 ± 0.43 mg AAE/gm). The present study concluded that, among the various herbal teas, rose and marigold had stronger antioxidant activity and poly phenol contents than green tea. The antioxidants levels of green tea were comparable to that of chrysanthemum tea and Hibiscus tea.

Keywords: Herbal teas, Flower infused tea, antioxidants, phenolics, flavonoids,

INTRODUCTION

Traditional and herbal teas have been consumed for centuries, not only for their taste, but as disease preventing agents. Traditional tea, derived from the plant *Camellia sinensis*, is the most widely consumed beverage in the world next to water but recently herbal teas are increasing in popularity. Herbal tea made up of edible flowers such as *Dahlia mignon*, *Rosa damascene*, *Calendula officinalis L* etc., are a good source of phytochemicals, including phenolic compounds[1].

Herbal flower teas have various health benefits which include anti-cancer, hypotensive, anti-diabetic, and anti-mutagenic properties[2]. The natural antioxidants such as phenolic acids and flavonoids present in the flowers could be strongly related to their colour either directly (e.g., anthocyanins and other flavonoid pigments) or indirectly through the co-pigmentation processes[3]. According to World Health Organization, 70-80% of the world's population benefits from traditional medicine. Herbal flower tea contains various phytochemicals such as catechins, theaflavins, flavonol glycosides, flavone glycosides, caffeine, gallic acid, and proanthocyanidins. In many countries such as India and china, where traditional medicines are widely use, herbal beverages have been used as natural part of the food culture.

Rose tea is a caffeine-free beverage with high antioxidant capacity due to presence of high content of phenolic compounds, in particular free gallic acid[4]. Rose tea could have strong anti-diabetic effect which may be mediated by inhibition of α-glucosidase that suppresses carbohydrate absorption from the small intestine and hence reduces the postprandial glucose level[5].

Marigold flowers contain quercetagetin, a glucoside of quercetagetin, phenolics, syringic acid, methyl-3,5-dihydroxy-4-methoxy, benzoate, quercetin, thienyl and ethyl gallate[6]. The lutein present in marigold flowers can be used in the formulation of nutritional supplements for the prevention of age-related macular degeneration[7].

Hibiscus tea commonly known as sorrel, bissap, or sour tea, is one of the more common herbal teas incorporated into tea blends worldwide. Hibiscus tea has various health promoting properties such as anti-hypertensive, hypo-cholesterolemic, antimicrobial and anti-cancer effects[8]. The high antioxidant activity found in hibiscus tea could be attributed to poly phenol content and other antioxidants such as ascorbic acid, eugenol, and limonene[9]. The chrysanthemum tea has strong anti-inflammatory properties due to their ability to suppress the relative mRNA expressions of IL-6, IL-1β, and COX-2 in LPS-induced RAW 264.7 macrophages[10].

The presence of caffeine in green and black teas causes a transient increase in blood pressure after their consumption. However, the flower petals do not contain caffeine or similar alkaloids and the flower tea may serve as a safe, caffeine-free, antioxidant beverage. Thus, in current scenario, herbal beverages need to be consumed as part of a balanced diet to reduce the risk of a number of disease conditions such as hyperglycemia, dyslipidaemia, cancer, and hypercholesterolemia.

The objectives of this study is to study antioxidant power by using modified ferric ion reducing antioxidant power assay (FRAP), total phenolic contents and total flavonoid contents of water extracts of rose, marigold, chrysanthemum and marigold for their use as herbal flower tea. The black and green teas (*Camellia*

sinensis) were taken as positive control for comparison in view of their potential benefits of natural antioxidants for food and medicinal purposes.

MATERIALS AND METHOD

Processing of flowers

Various flowers like rose, marigold, chrysanthemum and hibiscus were collected separately from local parks and dried in hot air oven at 70 degrees for 3-5 days. The dried flower petal were powdered and stored at room temperature. The black and green tea was procured from local market.

Sample extraction

1 g of dried rose, marigold, chrysanthemum, hibiscus, green tea and black tea was weighted into a beaker and 100 ml of boiling distilled water was added. After brewing for 5 min, the blend was removed and the extract was cooled down. All analyses of aqueous tea extracts were done in triplicate

Estimation of total phenol content (TPC)

The total phenol content (TPC) was determined by spectrophotometer using tannic acid as standard with some modifications[11]. 1.0 ml of the diluted sample extract (in triplicate) was added to tubes containing 5.0 ml of 1/10 dilution of Folin - Ciocalteu's reagent in water. Then, 4.0 ml of a sodium carbonate solution (7.5% w/v) was added and incubated at room temperature for one hour. The absorbance was measured at 765 nm. The total phenolic content was calculated from the calibration curve, and the results were expressed as mg of tannic acid equivalent per g dry weight (mg TAE/g).

Determination of Total flavonoid content

Total flavonoid content was measured by the modified aluminium chloride colorimetric assay[11]. The reaction mixture consisted of 1 ml of extract and 4 ml of distilled water taken in a 10 ml volumetric flask. To the flask, 0.30 ml of 5 % sodium nitrite was added and after 5 minutes, 0.3 ml of 10 % aluminium chloride was mixed. After 5 minutes, 2 ml of 1M Sodium hydroxide was added and final volume of the mixture was brought to 10 mL with double-distilled water. The absorbance for test and standard solutions were determined against the reagent blank at 510 nm with an UV/Visible spectrophotometer. The total flavonoid content was calculated from the calibration curve and was expressed as mg Ascorbic acid equivalent AAE/g of extract.

Determination of antioxidant power by using modified ferric ion reducing antioxidant power assay (FRAP)

The total antioxidant capacity was determined spectro photometry, using ascorbic acid as standard using the modified FRAP assay[11]. 0.1 ml of extract was taken and to it 0.9 ml of ethanol, 5 ml of distilled water, 1.5 ml of HCl, 1.5 ml of potassium ferricyanide, 0.5 ml of 1% SDS and 0.5 ml of 0.2% of ferric chloride was added. This mixture was boiled in water bath at 50°C for 20 minutes and cooled rapidly. Absorbance was measured at 750 nm to measure the reducing power of the tea extract. The antioxidants in samples were derived from a standard curve of ascorbic acid and were expressed as mg ascorbic acid equivalent (AAE)/ g.

Statistical analysis

The assays were carried out in triplicate and the results were expressed as mean values and the standard deviation (SD). The statistical differences were done by one way ANOVA ($p \leq 0.05$).

RESULTS

The phenolics content in various flower tea infusions ranged from 406 ± 7.21 mg TAE/gm to 760.66 ± 5.03 mg TAE/gm, green tea (45.78 ± 5.8 mg TAE/gm) and black tea (42.45 ± 5.2 mg TAE/gm) (Figure 1). The highest phenolic levels were found in rose tea (760.66 ± 5.03 mg TAE/gm) followed by marigold (594 ± 4.16 mg TAE/gm), chrysanthemum (432.66 ± 5.03 mg TAE/gm), hibiscus (406 ± 7.21 mg TAE/gm), green tea (45.78 ± 5.8 mg TAE/gm) and black tea (42.45 ± 5.2 mg TAE/gm).

In the present study, the highest flavonoid levels were found in black tea (0.52 ± 0.03 mg AAE/gm) followed by rose tea (0.41 ± 0.01 mg AAE/gm), chrysanthemum (0.33 ± 0.02 mg AAE/gm), marigold (0.32 ± 0.12 mg AAE/gm), Hibiscus (0.2 ± 0.02 mg AAE/gm) and green tea (0.39 ± 0.01 mg AAE/gm) (Figure 2).

As observed from the results, floral tea tested in the present study exhibited antioxidant activities (Figure 3). The highest antioxidant levels were found in rose tea (39.03 ± 0.50 mg AAE/gm) followed by marigold (30.76 ± 0.40 mg AAE/gm), chrysanthemum (11.39 ± 0.892 mg AAE/gm), green tea (9.71 ± 0.61 mg AAE/gm), Hibiscus tea (9.25 ± 0.43 mg AAE/gm) and black tea (3.83 ± 0.36 mg AAE/gm). The antioxidants levels in rose tea were significantly higher than marigold tea ($p \leq 0.05$).

DISCUSSION

Herbal flower teas are gaining popularity because of their fragrance, antioxidant properties and therapeutic application. In the present study, the phenolic content of rose tea was higher than that of the green tea, which is known to be one of the healthiest beverages[4]. The high antioxidant activity reported in rose tea among various other flower teas was also reported in literature[12]. The high antioxidant activity of the rose tea could be due to presence of phenolics like flavonols kaempferol and quercetin present in rose petals mainly in glycoside-bound form[4]. The presence of free gallic acid in rose tea which is rapidly absorbed by humans after oral administration, make it a better beverage than green tea where gallic acid is present predominantly in a conjugated form[13]. Gallic acid has antioxidant, anti-mutagenic, anti-carcinogenic, antimicrobial, anti-inflammatory, and analgesic effect. Due to its high content in anti-oxidative molecules, rose tea could have protective effect in other disorders associated with a disruption in redox balance such as AKI, DN, hepatotoxicity or peptic ulcer disease. They also have anti-inflammatory activity, and hence they could constitute a potential therapy in diseases associated with an enhanced inflammatory response, such as AD or skin aging[14].

The herbal tea made from marigold flowers showed high phenolics and antioxidant activity as reported earlier in studies on Indian marigold flowers[15]. The strong antioxidant activity of marigold tea could be due to the presence of phytochemicls such as rutin, isoquercitrin, quercetin-3-O-rutinosylrhamnoside, isorhamnetin-3-O-rutinosylrhamnoside, isorhamnetin-3-O-glucosylgluco-side and isorhamnetin-3-O-glucoside. The herbal tea made with water extract of marigold flower might contain the polar compounds such as triglycosyl flavonoids which contribute to stronger scavenging and antioxidant activity.

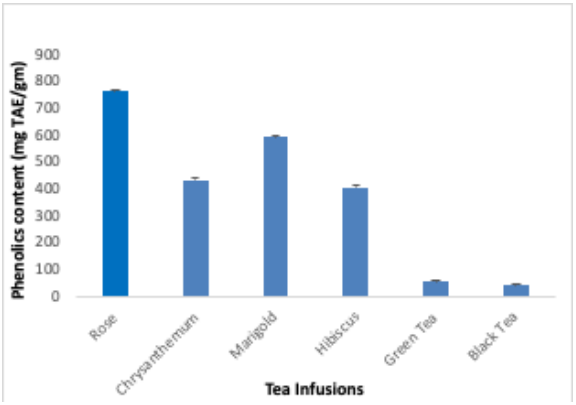

Figure 1: Phenolic levels in Flower teas, Green tea and Black tea

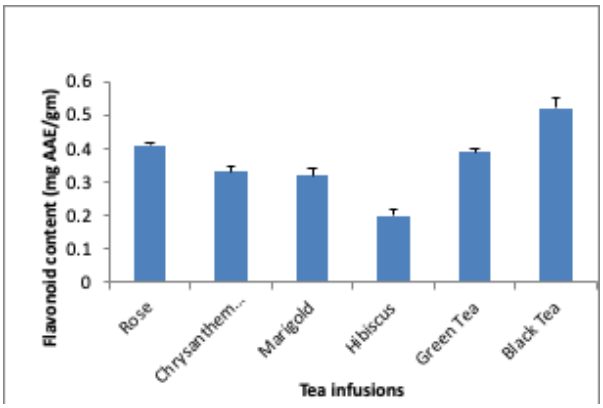

Figure 2: Flavonoid levels in Flower teas, Green tea and Black tea

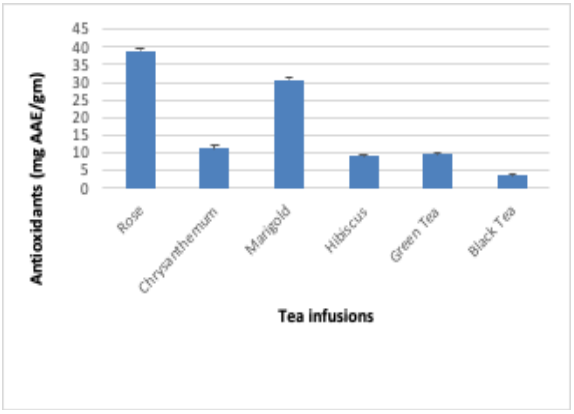

Figure 3: Antioxidant levels in Flower teas, Green tea and Black tea

The antioxidant activity of chrysanthemum tea could be due to presence of phenols such as chlorogenic acid and 3,5-dicaffeoylquinic acid and flavonoids such as luteolin-7-*O*-β-glucoside apigenin-7-*O*-β-glucoside, linarin, acacetin-7-*O*-β-glucoside, luteolin and apigenin[16]. The Luteolin 7-O-(6″O-malonyl)-glucoside is a predominant flavonoid with the strongest radical scavenging activity which might inhibit oxidative stress by the decrease of serum MDA content and the elevation of SOD and GSH-Px levels[17]. The chrysanthemum flavonoids including luteolin and diosmetin might contribute to the eye health improvement by preventing oxidative stress-induced cell death and inflammatory damages and also by suppressing the activity of rat lens aldose reductase[16].

In the present study, hibiscus tea has low phenolics, flavonoid and antioxidant level as reported in the literature[18,19]. The common phenolic compounds present in Hibiscus tea are quercetin, luteolinglucoside and chloro-genic acid, anthocyanins delphidin-3-sambubioside and cyanidin-3-sambubioside. These compounds are known to attenuate atherosclerosis through several mechanisms such as inhibition of LDL oxidation and smooth muscle cell proliferation[20]. The hibiscus tea extract reduce intracellular reactive oxygen species formation of primary vascular endothelial cells and improve cell viability, following oxidative stress[21]. Thus hibiscus tea has soothing and refreshing hypotensive activity which could be due to its vascular smooth muscle vaso-relaxant properties[22]. The presence of anthocyanins, flavonoids and poly phenols in the hibiscus tea also promotes cholesterol reduction in human serum[23].

CONCLUSION

It was clearly demonstrated that rose, marigold, chrysanthemum and hibiscus tea had stronger antioxidant activity and poly phenol contents that were superior or comparable to black and green teas. The highest antioxidant activity was shown by rose followed by marigold tea, chrysanthemum tea, green tea, Hibiscus tea and black tea. Thus, herbal tea made from flowers can be used as refreshing caffeine free drink with medical benefits.

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